PRESIDENTIAL ADDRESS*

Observations on Beekeeping in Hawaii

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Beekeeping in Hawaii dates from 1857, when the first bees were said to have been introduced from California.[1] It is assumed these bees were the German or black race of bees. Later, according to his own statement to the writer, the late Mr. Gerrit P. Wilder introduced the first Italian bees. The bees now in Hawaii are mixtures of these two races. Hawaii boasts of some of the largest apiaries in the world, although during the last 10 years, when the price of honey was low, some of these apiaries have diminished in size. Now with improving markets increase is being made in the number of colonies in most apiaries.

Prior to the effective biological control of the sugarcane leafhopper (*Perkinsiella saccharicida* Kirk.), the bulk of export honey from Hawaii was "honeydew" honey, a sweet secretion of the sugarcane leafhopper and aphids, or a mixture of honeydew with floral nectar, and was considered a poor grade of honey. It was consumed principally by the baking trades. So notorious was the reputation of Hawaiian honey for containing honeydew that it is still thought on the mainland that Hawaiian honey is mixed with honeydew. As recently as December 1936 there was discussion at the State Beekeepers Convention at San Bernardino, Calif., of ways and means of keeping Hawaiian honeydew from the markets of California. Since there were two beekeepers from Hawaii present at this meeting the beekeepers of California were assured that since the control of the sugarcane leafhopper in Hawaii honeydew honey was not produced in surplus quantities.

During the past seven years the writer has kept from two to twelve colonies of bees as a hobby and has visited several commercial apiaries in Hawaii. During this time many casual obser-

[1] Coffey, Heber, E. A Malihini Views Hawaiian Beekeeping. Amer. Bee Jour., Sept. 1934; pp. 402-403.

* President Keck was absent on the mainland at the time of the annual meeting, December 3, 1936. This paper was turned in after his return.—[Ed.]

vations have been made concerning commercial honey plants, lesser honey plants, the importation of queens, average colony production, and the possibilities for the increase of colony production. It is the purpose of this paper to record some of these observations with suggestions which may prove helpful to beekeepers in Hawaii. It is, however, only as a private beekeeper that the writer wishes to speak and he does not in any way speak for, or represent, the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture.

Conditions Favorable to the Beekeeper in Hawaii.

There is practically no time during the year in Hawaii when a colony of bees of reasonable size cannot gather nectar and pollen to maintain itself. In the lowlands there is no time during the year when the colony needs to form a cluster to keep warm. Robbing, which is such a nuisance among bees on the mainland, seldom occurs in Hawaii because there are always a few plants blooming which supply a little nectar and pollen to occupy the bees. However, robbing cannot be ignored in large apiaries, when there is a dearth of nectar and hives are opened.

Although algaroba or kiawe (*Prosopis juliflora* (Sw.) De Candolle), is the main source of honey in the islands there are other plants such as eucalyptus, lantana, coconut, and others which may produce surplus honey if the beekeeper will move his bees to areas where these plants are plentiful during the honey flow from them. These plants are also very important for supplying stores for winter and for spring brood rearing.

Conditions Unfavorable to Beekeeping in Hawaii.

The amount and time of rainfall are likely to influence the amount of honey gathered more than any other climatic factors. On the island of Oahu, especially, misting rains which drift down the valleys may reduce the amount of honey produced. During the season of 1936 in the vicinity of the University of Hawaii the honey crop was reduced approximately 50 percent, in the opinion of the writer, because of almost constant misting rains. During this period actually only a small amount of water fell, but misting showers occurred for prolonged periods, practically every day.

Of the serious brood diseases of bees, only American foulbrood caused by *Bacillus larvae* and sacbrood caused by a filterable virus are present in Hawaii. A bacterial disease known as European foulbrood does not occur in Hawaii so far as is known by the author. It is very necessary that the commercial beekeeper become familiar with the symptoms of American foulbrood and sacbrood since these two diseases do not respond to the same treatment.

Ants may become serious pests around the apiary but usually do not cause trouble if the colonies are strong. It is advisable, however, to place hives on hive stands constructed in such a way that a small amount of sticky tree-banding material or oil applied to the legs of the stand will protect the colony from ants.

The giant toad *Bufo marinus* (Linné) is said to relish bees as a food. Examinations have been made many times to determine if this toad was eating bees in the writer's small apiary. Although toads are known to be breeding only about 20 yards away none have been found in the apiary. It is believed that this is due to the protective location of the apiary and it is suggested that in the location of the apiary the prevalence or accessibility to toads should be considered. It is further suggested that to protect individual colonies from toads they be elevated at least 18 inches from the ground and a sheet of quarter inch mesh wire screen be secured as an extension for at least 12 inches to the front of the alighting board of the hive and on the same plane with it. This wire will act as a shield to prevent the toads from jumping up and catching the bees. Adequate ventilation of the hive will also help in preventing "hanging out" at the entrance of the hive in the evening when toads become active.

There is no Territorial agency that specializes in beekeeping or carries on research to which the beekeeper can go for expert information, nor is there inspection for brood diseases, although this was done for one season by the Board of Agriculture and Forestry as an extra activity.

Management that will Aid Production.

While beekeepers in Hawaii, for the most part, use standard hives, in some cases they do not use full sheets of foundation in completely wired frames or full sheets of reinforced wire founda-

tion in frames with one or two wires as starters for brood combs and extraction combs. This is false economy since brood and extracting combs will last for as long as 20 years when produced and cared for properly. When only strips of foundation are used in the brood nest large areas of comb are drawn out as drone cells, and the drones produced only reduce the surplus honey and crowd the brood nest, which is one of the main causes for swarming. If wire reinforcement is not used in the foundation to produce extracting combs, excess breakage results in the extracting process.

There is an enormous difference in the average production per colony in different commercial apiaries. In one apiary with approximately 2,000 colonies the yearly expected average is from 30 to 50 pounds while in another apiary of approximately 500 colonies an actual average of 192 pounds of extracted honey was obtained during the season of 1936. The 192 pound average of extracted honey does not appear to be an unusual crop of honey when one or two colonies in small back-yard apiaries will produce from 200 to 225 comb-honey sections in a season. It is well-known that a colony of bees will produce approximately one-third more extracted honey than comb honey. It appears reasonable to assume that if a commercial apiary has an average production of less than 100 pounds per colony there is something wrong with the management. The successful honey producer should have his colonies built up to maximum strength at the beginning of the honey flow. One essential for a strong colony is a vigorous young queen. The queen is the main part of the colony since she lays all the eggs for the colony. A strong colony at the peak of the season may contain as high as one hundred thousand workers. Since workers live only from 6 to 8 weeks during the active season the queen must lay about 2,000 eggs per day to maintain the colony. In Hawaii, brood rearing continues throughout the year and this adds an extra burden on the queen. The bees instinctively replace or supersede the queen when she shows signs of failing, and she is most likely to fail during the peak of brood rearing. Therefore, since there may be a break in egg laying of from 1 to 3 weeks during supersedure, the surplus or beekeeper's portion of the honey crop is reduced. The beekeeper can avoid the possibility of supersedure by supplying each colony with a young queen

from 1 to 3 months before the peak of brood rearing. It is the writer's opinion that this should be done, in Hawaii, about February of each year, and this has been borne out by experience.

To obtain young vigorous queens it is believed that best results will be had by rearing one's own queens from eggs from a queen imported from a reliable queen breeder on the mainland. The trip by steamship to Hawaii is so severe that to secure queens from mainland producers to head honey-producing colonies in Hawaii is almost certain to produce supersedure during the succeeding honey flow; furthermore, queens are not available on the mainland at the time when needed most in Hawaii. If the beekeeper is isolated or has a large number of colonies, queens of practically the same breeding as the original mainland queen can be produced by requeening all colonies twice with queens reared from eggs from the mainland queen. A period of approximately 3 months must elapse between each requeening in order to eliminate all hybrid drones which were originally present in the apiary and with which the first set of queens would naturally mate. The first set of daughters of the mainland queen will produce hybrid workers (each worker will be of half mainland stock and half hybrid stock) and drones will be produced which are of pure mainland stock since the drone is from an unfertilized egg. Therefore, a second requeening, after 2 or 3 months has elapsed, with queens reared from eggs from the original mainland queen, will result in workers of pure stock, since the drones present at that time are of the original mainland stock provided the apiary is isolated from hybrid bees. The original mainland queen may be kept for several years as a breeder if she is kept in a weak colony to make it easier to guard against supersedure.

It should be the aim of the beekeeper to have his colonies built up to maximum strength just before the blooming of the main honey plant. During the off honey season colonies are usually reduced to 15,000 bees, while at the peak of brood rearing the colony should contain at least 60,000 bees. It was found by Farrar[2] that a colony containing 60,000 worker bees will produce 1.54 times as much honey as four colonies each with 15,000 bees.

[2] Farrar, C. L. The Influence of Colony Populations on Honey Production. Jour. Agr. Research, Vol. 54, No. 12, pp. 945-954, June 15, 1937.

Honey Plants and Their Seasons.

The beginning of the honey flow from algaroba may vary from 1 to 3 months, depending upon rainfall and other climatic conditions. This is also true of the other lesser honey plants. The beekeeper should study the sources of nectar in his locality as well as the succession of honey flows available to him. By migrating from algaroba to eucalyptus and lantana, surplus honey for brood rearing in building up colonies for the next crop may at least be obtained. In a location where lantana was blooming during March and April of 1937, a colony produced about 35 sections of comb honey. The writer suggested to a commercial honey producer that a few colonies be moved to a eucalyptus area after the algaroba flow was over. This was done during the season of 1936 and approximately 30 pounds of eucalyptus honey per colony was obtained. It is the writer's opinion that this surplus from eucalyptus should be left with the colonies to aid in brood rearing in building up for the algaroba flow instead of forcing the colony to delay brood rearing until the algaroba flow starts and then build up an excess population at the expense of the honey crop. The algaroba flow may occur as early as April or be retarded by dry weather until July, and the beekeeper should be able to estimate in advance the time when the next bloom will occur. The eucalyptus flow appears to be more uniform as to time and occurs in August usually after the algaroba flow is over. The lantana honey flow depends, more than either algaroba or eucalyptus, upon rainfall as to the time of its occurrence. It is not known to the writer whether or not lantana blooms profusely twice yearly but blooming and consequent honey flows have been noted both late in the fall and early in the spring. There is an almost continuous light bloom on lantana throughout the year if moisture conditions are right. A very light flow may be gotten from coconut for almost the entire year if the bees are close to a large coconut grove.

The lesser honey plants in Hawaii are almost too numerous to mention. There is hardly a time when a small number of plants of some variety are not blooming and furnishing nectar and pollen for brood rearing and perhaps a little surplus for the beekeeper.

The Need for Inspection Service and Research.

Earlier in this discussion mention was made of the need for inspection of apiaries for brood diseases in Hawaii. A request for such a department to be added to the Entomology Department of the Board of Agriculture and Forestry was made of the 1937 legislature by the beekeepers of Hawaii. This met with a favorable response but nothing was done about it during the 1937 session. There is a great need for such a department with a trained apiculturist in charge. Inspection can only be done thoroughly by a government agency. The most serious brood disease, American foulbrood, is a disease of strong colonies, that is, it often shows up in the strong colonies of an apiary first. The honey of the diseased colony becomes contaminated with the spores of the causal organism, *Bacillus larvae*. The strong colonies in the neighborhood will rob from the diseased colony, which is now so weakened by disease that it falls easy prey for a strong colony. Therefore, the only protection for the commercial beekeeper is to have all bees in the neighborhood inspected by some governmental agency. Even though a careful beekeeper cleans up all infection in his own apiary, his apiary may be continuously exposed to reinfection by other bees in the neighborhood which are not well kept. Definite progress has been made in the past few years in the artificial insemination of queen bees, and this in the future may permit of the controlled mating of queens. Other experiments and observations indicate that there do exist strains of bees which are at least partially resistant to American foulbrood and even now queens are being reared from stock which shows apparent resistance. It was indicated to the writer on a recent trip to the mainland that as queens are available it would be desirable to send queens to some governmental agency in Hawaii for testing for disease resistance under Hawaiian conditions. If a disease-resistent strain is found, it would be of great value to beekeepers of Hawaii to be able to obtain stock. The addition of an apiculturist to the staff of the Board of Agriculture and Forestry well deserves the support of the Hawaiian Entomological Society.